



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,353	02/17/2004	Jennifer Wang	P1571	9226
7590 09/05/2007 LaRiviere, Grubman & Payne, LLP P.O. Box 3140 Monterey, CA 93942				
EXAMINER				
MAL ANH D				
ART UNIT		PAPER NUMBER		
2814				
MAIL DATE		DELIVERY MODE		
09/05/2007		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/781,353

**Applicant(s)**

WANG ET AL.

**Examiner**

Anh D. Mai

**Art Unit**

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 April 2007.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-27 is/are pending in the application.  
4a) Of the above claim(s) 1-20 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 21-27 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SG/US)  
Paper No(s)/Mail Date \_\_\_\_\_  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Status of the Claims***

1. After Final Amendment filed April 2, 2007 is acknowledged. Claims 22, 24, 25 and 27 has been amended. Claims 1-27 are pending. Non-elected invention, claims 1-20 have been withdrawn.

Action on merits of claims 21-27 follows.

### ***Pre-Appeal Brief Request for Review***

2. A Request for Review has been filed of April 30, 2007. The rejection mailed January 31, 2007 has been withdrawn. The Action on merit of the Amendment filed April 2, 2007 follows.

### ***Claim Objections***

3. Claim 22 objected to because of the following informalities: line 4 recites: "via-opening" and line 8 recites; "via hole".

The claimed terms are inconsistency.

Appropriate correction is required.

4. The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

The true inventive features have been obscured by the inclusion of non-existing process elements.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 21, 22 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Lin (U.S. Patent No. 6,515,369) of record.

With respect to claim 21, insofar as the device is concerned Lin teaches a device including a via as claimed including:

a polymer layer (20);

a via hole with at least one vertical sidewall,

whereby the via hole comprises an aspect ratio which is greater than 1, and is of substantially the same diameter throughout the depth of the via hole. (See Figs. 5a).

With respect to claim 22, insofar as the device is concerned and in light of the Applicant's Remarks in the Pre-Appeal Brief Request for Review, Lin teaches a device including a via as claimed including:

a polymer layer (20) having a sub-micron wide via-opening formed on a semiconductor substrate (10);

whereby the via hole comprises an aspect ratio which is greater than 1, and is of substantially the same diameter through out at least one-half the depth of the via hole and at least one tapered sidewall within the via hole. (See at least Fig. 10).

With respect to claim 25, Insofar as the device is concerned, Lin teaches a device as claimed including:

a polymer layer (20);

a via hole having sub-micron wide formed in the polymer layer (20), the via hole having at least one vertical sidewall;

whereby the via hole comprises an aspect ratio which is greater than 1, and is of substantially the same diameter through out at least one-half the depth of the via hole; and at least one tapered sidewall within the via hole. (See Fig. 10).

Product by process limitation: (applies to all claims)

The expression “a via produced by the process comprising the steps of” and “*placing a hard-mask on a polymer layer; placing a photoresist mask on said hard-mask; releasing a first fluoride gas into a chamber to etch a hard-mask opening for defining a via hole; releasing a second fluoride gas into said chamber to etch an exposed portion of said polymer layer defining said via hole with vertical sidewalls; releasing a third fluoride gas into said chamber to etch an exposed portion of said polymer layer defining said via hole with at least one tapered sidewall*” is/are taken to be a product by process limitation and *are given no patentable weight*. A product by process claim directed to the product per se, no matter how actually made, *In re Hirao*, 190

USPQ 15 at 17 (footnote 3). See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al.*, 218 USPQ 289, 292 (Fed. Cir. 1983); *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935); and particularly *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product “gleaned” from the process steps, which must be determined in a “product by process” claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in “product by process” claims or not.

**Note that Applicant has burden of proof in such cases** as the above case law makes clear.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. (U.S. Patent No. 6,004,883) in view of Lin (U.S. Pub. No. 2002/0068441) all of record, as previously applied.

With respect to claim 21, insofar as the device is concerned and as best understood by the examiner, Yu teaches a device including a via substantially as claimed including:

a hard mask (18) on a polymer layer (16);

a photoresist mask (20) on the hard mask (18)

at least one via hole (25) with vertical sidewall, defined in the polymer layer (16), and is of substantially the same diameter throughout the depth of the via hole (25). (See Figs. 2-3).

Thus, Yu is shown to teach all the features of the claim with the exception of explicitly disclosing the aspect ratio of the via.

However, Lin teaches via (7) defined in a polymer layer (5) having an aspect ratio of greater than 1 are routinely used to for the contact in ULSI, and is of substantially the same diameter throughout the depth of the via hole.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to define the via of Yu having an aspect ratio of greater than 1 in the polymer layer as taught by Lin to form contacts to a lower layer with smaller resistance and capacitance and is easier and more cost effective to manufacture.

Additionally, it would have been an obvious matter of design choice to define a via having aspect ratio greater than 1, since such a modification would have involve a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

Furthermore, the specification contains no disclosure of either the *critical nature of the claimed aspect ratio of greater than 1* of any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Also, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum aspect ratio of the via. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

Product by process limitation:

The expression "a via produced by the process comprising the steps of" and "*placing*" and "*releasing a first fluoride gas into a chamber to etch a hard-mask opening for defining said via hole; and releasing a second fluoride gas into said chamber to etch an exposed portion of said polymer layer defining said via hole with vertical sidewalls*" is/are taken to be a product by process limitation and *are given no patentable weight*. A product by process claim directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al.*, 218 USPQ 289, 292 (Fed. Cir. 1983); *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935); and particularly *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product "gleaned" from the process steps, which must be determined in a "product by



process” claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in “product by process” claims or not.

**Note that Applicant has burden of proof in such cases** as the above case law makes clear.

7. Claims 23, 24, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin ‘369.

Lin teaches the via hole as describe in claims 22 and 25 above including the via hole having aspect ratio which is greater than 1, and is of substantially the same diameter through out at least one-half the depth of the via hole and the via of Lin also includes a tapered sidewall within the via. (See Fig. 10).

Thus, Lin is shown to teach all the features of the claim with the exception of explicitly disclosing the tapered sidewall extending at least one-third or one-half of the depth.

Note that the specification contains no disclosure of either the *critical nature of the claimed extending of the tapered sidewall in the range from one-third to one-half* of any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the tapered portion of the via of Lin so that contact to the lower pad can be

made with smaller resistance and capacitance and is easier and more cost effective to manufacture.

Furthermore, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum depth of the taper sidewall. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) “It is not inventive to discover optimum or workable ranges by routine experimentation”.

#### ***Response to Arguments***

8. Applicant's arguments filed April 30, 2007 with respect to the motivation to combine have been fully considered but they are not persuasive.

Applicant argues that the Examiner fails to point out where there is a suggestion or motivation to combine within the cited references.

Note that, the motivation to combine does not need to be only within the references, but can also be determined by the knowledge of one having ordinary skill in the art.

The references clearly form the via for making contact between the upper and lower levels of the semiconductor device regardless of the aspect ratio.

For the interest of bringing the application to a conclusion, the motivation to combine is provide by the reference to Lin ‘369.

For in-depth analysis of the obviousness, Applicant is directed the most region Decision by the Supreme Court regarding the motivation to combine in *KSR International Co. v. Teleflex Inc.*

***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Anh D. Mai/  
Primary Examiner, Art Unit 2814